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OBSERVATIONS

ON THE

GEOLOGY AND PHYSICAL CHARACTERISTICS
OF NEWFOUNDLAND.

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Society of New Brunswick, &c, &c.

(Extracted from the *Canadian Naturalist* for October, 1862.)

This well-known Island lies on the north-east side of the entrance into the Gulf of St. Lawrence. It is separated from Canada by the Gulf; its South West point, Cape Ray, approaches Cape Breton; to the North and North East, are the shores of Labrador, from which it is divided by the Straits of Belleisle; and its eastern coast is washed by the North Atlantic.

Its form is somewhat triangular, but, without any approach to regularity, each of its sides being broken by numerous bays, harbours, creeks, and estuaries. In straight lines, as the sea-gull would wing its flight, its circuit is not much less than 1000 miles.

Its width at the widest part, between Cape Ray and Cape Bonavista, is about 300 miles. Its extreme length from Cape Race to Quirpen, at its north-east extremity, is about 419 miles, measured on a curve through the centre of the island. Its area is estimated at 36,000 square miles, equal to 23,040,000 acres.

Newfoundland is the nearest part of America to Europe, the distance from St. John's, the capital, to Valentia in Ireland, being only 1656 miles.

From the sea, Newfoundland has a wild and rugged appearance, which is anything but inviting. Of its interior, very little is known, as it has been but very partially explored. Such parts as have been visited by persons capable of giving a satisfactory description, were found much broken up with water; lakes, and marshes, rocks and scrubby trees, forming its chief features.

The prevailing character of Newfoundland is that of a rugged, and, for the most part, a barren country. Hills and valleys continually succeed each other; the former, but seldom rising into mountains, and the latter, rarely expanding into plains.

The hills, more or less lofty, are greatly varied in character. Sometimes they form long flat-topped ridges; occasionally, they become round and isolated, with sharp peaks and craggy precipices.

The valleys also vary greatly. Sometimes they present deep mountain gorges, and the wildest of ravines; while in others, they form depressions with gentle slopes toward the water, which is ever found flowing at their greatest depth.

Thesea-cliffs of Newfoundland,—especially on the coast, between St. John's and Cape Race, thence westwardly, between Cape Race and Cape Ray, and thence northerly along the western coast and Bonne Bay,—are almost everywhere bold and lofty, with deep water close at their foot.

Loose rocks of all sizes, and with them huge boulders, are scattered all over the country. They increase the general roughness of its appearance, and give it a repulsive character.

This rough and rugged surface is covered by three different kinds of vegetation, which form three distinct districts.

The people of Newfoundland assign to these several districts, the names of, "Woods, Marshes, and Barrens."

The woods are in general found on the sides of hills, or the slopes of valleys, wherever there is natural drainage for the surplus water. For this reason, the forests, if they can be so called, occur most frequently, and the trees are of the greatest size, near the sea-coast, or near lakes and rivers, when the soil and other circumstances are favourable.

Newfoundland has been frequently described as a thickly wooded country, but such is not the case. The trees consist chiefly of spruce, (*Abies nigra*,)—white fir, (*Abies alba*,)—yellow birch (*Betula excelsa*,)—white birch, (*Betula populifolia*,)—and hackmatack or larch, (*Larix Americana*.) But what are considered large

trees in Newfoundland, and were pointed out to the writer as timber trees, would be laughed at by a New Brunswick lumberman, and not deemed worthy of his axe.

On the eastern or Atlantic coast of Newfoundland, there is but little wood of any value, except for fuel, and the building of fishing boats.

In the northern part of the island, on the limestone formation, it is said that formerly extensive forests existed, but that great fires destroyed the largest trees, and these have been succeeded by others of an inferior and much smaller species.

The greater part of the wood is of small and stunted growth, consisting chiefly of fir trees, about 20 or 30 feet high, and not more than 3 or 4 inches in diameter. In general, these insignificant trees grow so close together, that their twigs and branches interlace from top to bottom. The endless quantity of decayed trees, rotten stumps and branches, newly fallen trees, combined with the young shoots, and tangled brushwood, form very frequently a thicket that is almost impenetrable.

The trees are often covered with lichens, and tufts of white, dry moss, are entangled about the branches. Other green and softer mosses spread over the ground, concealing alike the gnarled and twisted roots of the standing trees, the pointed stumps of those that have fallen, the sharp edges and most slippery surfaces of the numerous rocks and boulders, and the holes and pit-falls between them.

Every step in the woods and wilds of Newfoundland is matter of toil and anxiety, requiring constant vigilance to avoid falling, and unremitting labour to find standing room. Climbing, creeping, and every other mode of progression, must be used to get onward. The course has constantly to be changed, and new directions are taken, in order to find those places through which to force a slow and tortuous way.

During the heat of summer, or what is called such in Newfoundland, the thickness of the low and stunted trees shuts out every breath of air, while they are not sufficiently thick at top to exclude the scalding rays of the sun. And this heated atmosphere is rendered more unpleasant by the strong smell of turpentine which emanates from every pore of the scrubby spruces and firs.

Such are the leading characteristics of what in Newfoundland are called "the woods." Embosomed in these woods, and cover-

ing the valleys and lower lands, are found large open tracts which are called "marshes."

Let it be understood that these marshes are not always low-lying lands, or even very level. They are frequently found at a considerable height above the sea, and often with an undulating surface.

Moss covers these marshes to the depth of several feet; it is green, soft, and spongy, and is bound together by straggling grass, and a variety of marsh plants. The surface is uneven, abounding in holes and hillocks, the tops of the hillocks being frequently covered with a short, dry, crisp moss.

The various colours of the mosses on these marshes, give them a peculiarly rich appearance, especially if seen from a distance, clothing the slopes of a hill with tufts or thin skirts of wood, scattered about. In such cases, a person not acquainted with the country would be led to believe it possessed great agricultural capabilities, and might be highly cultivated.

Except in long continued droughts or hard frosts, these marshes are always wet, and incapable of bearing the weight of a person walking across them. A march of three or four miles across a Newfoundland marsh, sinking into the moss at every step, always as far as the ankle, but sometimes knee-deep, is a most fatiguing operation, and most toilsome if a load has to be carried on the shoulders.

This thick coating of moss is precisely like a great sponge spread over the country. At the melting of the snow in spring, it becomes thoroughly saturated with water, which it long retains and which every rain-fall continually renews.

Numerous ponds of water are found everywhere in Newfoundland; and it is scarcely possible to walk a mile, in any direction, without encountering large pools, sometimes spreading out into very considerable lakes. In the lower parts small sluggish brooks or gullies are met with everywhere.

The extreme wetness of the marshes is due almost entirely to the spongy nature of the moss, as the slope of the ground is in almost every case quite sufficient for surface drainage.

Where the moss is stripped off these so-called marshes, either dry, rounded gravel, or bare rock, is generally found beneath.

Next we come to,—

The "barrens" of Newfoundland, which are extensive dis-

tracts occupying the summits of the hills and ridges, and other elevated and exposed positions. They are covered partially with a thin, scrubby vegetation, consisting of berry-bearing plants and dwarf bushes.

Bare patches of gravel and boulders, and crumbling fragments of rock, are frequently met with in the barrens, and generally they are altogether destitute of vegetable soil.

It is only by means of these barrens, these stony sterile tracts, that any large portion of the interior of Newfoundland can be visited or explored. Though frequently broken, rugged, and precipitous, they are delightful to tread upon after traversing the heavy marshes or toiling through the tangled and annoying woods.

Sometimes, in the hollows of the barrens, and in other places, where the disintegration of the rocks has created a little soil, a bed of dwarf hackmatack or larch is met with. These stunted trees are called in Newfoundland "tucking bushes;" they grow about breast-high, with strong branches at right angles to the stem, all stiffly interlaced, the tops being as flat and level as if they had been hewn off. These "tucking bushes" are so stiff that in some places one can almost walk upon them; but as this is not quite possible, the labour of pushing and thrusting through them can scarcely be conceived by those who have not made the attempt.

These different tracts, "woods, marshes, and barrens," are none of them of any great extent at any particular place; but they are continually alternating with each other in the course of a day's journey.

The most remarkable feature of Newfoundland is the immense and scarcely to be credited abundance of lakes of all sizes, all of which are called indiscriminately "ponds."

These are found universally over the whole country, not only on the valleys but on the highest lands, even on the hollows of the summits of the ridges, and on the very tops of the highest hills.

These ponds vary in size from pools of 50 yards in diameter to lakes upwards of 30 miles long, and 4 or 5 miles in width. The number of ponds which exceed a couple of miles in extent, must on the whole amount to several hundreds; those of smaller size are absolutely countless.

It has been estimated, that in Newfoundland the quantity of

ground covered by fresh water is fully one third of the island, and in this estimate I quite concur, believing it, if any thing, rather below the mark.

Taken in connection with this remarkable abundance of lakes and ponds, the scarcity of navigable rivers is almost anomalous. The broken and undulating character of the country with its craggy hills and deep ravines, is doubtless one cause of the absence of large rivers; while small rocky rattling streams are found in countless profusion.

Each lake, or small set of ponds, communicates with the sea by a valley of its own, of greater or less extent. Down this valley they send their superfluous waters, in what may be considered a mere brook. The general scantiness of these brooks, and the vast abundance of the ponds, are accounted for by the smallness of each system of drainage and the vast coating of moss found all over the country.

Upon every great accession of moisture, either from rain or melted snow, the chief portion is absorbed by this huge sponge; the residue fills the numerous ponds to the brink, and these discharge themselves gradually by the brooks.

Great periodical floods which would sweep out and deepen the channels of the rivers, are quite impossible, from the almost infinite number of small streams falling singly into the sea. These streams have not the power, at any time, of breaking down or overcoming the barriers which separate them, and so uniting their waters.

In dry weather, when the ponds begin to shrink, they are supplied by the slow and gradual drainage of the marshes, where the water has been kept as in a reservoir, to be given off when required. In this way, many ponds that have no great depth, and would otherwise be exhausted, are kept full of water in the driest seasons, and it is only in the greatest and most long continued droughts, when the marshes themselves begin to dry up, that the ponds are found to shrink much below their usual level.

CLIMATE.

As there are nearly five degrees of latitude between the southern and northern extremities of Newfoundland, there is of course a considerable difference in the severity and duration of winter. The climate of Conception Bay, which is in the south coast, and to the eastward of St. John's, the capital of the colony, is consi-

dered to afford what may be deemed the mean temperature of the island.

The weather there, although severe, is less fierce than in Lower Canada, and during winter, the extraordinary brilliancy of the Aurora Borealis, and the splendid lustre of the moon and stars, give a rare and peculiar beauty to the atmosphere.

The eastern coast of Newfoundland is much more humid than the western, owing to the heavy fogs which are driven in from the Grand Bank; and it is also more subject to violent gales and storms, owing to its exposed position. On the west coast, from Cape Ray to the north, and in the interior, the atmosphere is generally clear, and the climate is much the same as that of the district of Gaspé, in Lower Canada.

THE GEOLOGY OF NEWFOUNDLAND.

In the years 1839 and 1840, Mr. J. B. Jukes, a fellow of the Geological Society, who has since greatly distinguished himself in South Australia, was employed by the Government of Newfoundland to make a geological survey of the Island. The means placed at the disposal of Mr. Jukes by the Legislature, were exceedingly small, and it was only an ardent love of science, and a desire to do all that man could do, in an interesting but most difficult country, that induced Mr. Jukes to persevere as long as he did. Because Mr. Jukes, at the outset of his explorations, did not encounter anything of very great value, the Legislature declined to assist him in further researches, at the very point where those researches were beginning to be interesting, and becoming of practical value.

The only authentic account, therefore, of the Geology of Newfoundland, is that of Mr. Jukes, but to that has been added within a few years, the observations of other scientific men, who have been employed to explore certain sections of the island, with a view to discover its mineral wealth.

Mr. Jukes divides Newfoundland, geologically, into two sections, which are shown on the map by a line drawn from Cape Ray, the south-western angle of the island, to Quirpen, very nearly through the centre of the island.

To the south-westward of this line, the geological character of the country is such as to indicate a broken and sterile country, with but slight hope of mineral wealth; while to the Northward and eastward of the line, the country is composed of rocks of

much more recent character, including an extensive coal formation, with various indications of other minerals.

The aqueous or stratified rocks of Newfoundland consist of the following formations:—

The upper, and the lower, or red portion of the coal formation.

Next in the descending order, magnesian limestone. Then, an upper slate formation, consisting of shale and gritstone, and variegated shales.

Below these, a lower slate formation—and then the gneiss, and mica slate.

The unstratified, or igneous rocks, consist of various kinds of trap, greenstone, serpentine, hypersthene, porphyry, syenite, and granite.

The upper part of the coal formation consists principally of dark shales, with brown or yellow sandstones, or gritstones, in thin beds.

The lower part of this formation is characterised by beds of red sandstone, red and green marls, and gypsum.

These two portions of the coal formation pass by insensible gradations into each other.

Yellow, brown, and whitish flags and sandstones, dark blue clay, with an occasional bed of black shale, occur throughout the whole of the coal formation. Some of the lighter colored sandstones contain carbonate of lime, red and green marl, and large masses of gypsum in thick beds.

The total thickness of the coal formation is considerable, and the portion examined by Mr. Jukes had a thickness of 1000 to 1500 feet.

The magnesian limestone which was seen, was generally of a yellow colour, about 50 feet thick, in beds of 2 or 3 feet each, frequently splitting into flags.

One bed of carbonate of lime was found of a grey colour, about 2 feet thick, with a band of brown chert.

The upper slate formation is supposed to be below the coal formation in the series.

The superior portion consists of dark micaceous shale splitting into thin laminae, with interstratified beds of a very fine grained grey gritstone, which increase in number, thickness and coarseness of grain, with the increasing depth, until the shale disappears altogether. The thickness of the two portions seen is estimated at several hundred feet.

The lower slate series is deemed by Mr. Jukes to belong to an older formation and to be composed of two groups.

1st. A mass of grey and red sandstone, which at the entrance to the harbour of St. John's, has a thickness of 800 feet.

And 2nd. The St. John slates, in which beds of red, green and grey stone alternate near the junction of the sandstone and the slate rocks, forming the transition beds between the two. The thickness of this formation is estimated at between 2000 and 3000 feet.

The cleavage of the slate is frequently parallel to the line of stratification, and in these cases produces excellent roofing slate.

Veins of white quartz and masses of porphyry are found associated with these slates.

Descending lower in the Geological scale, there is found the mica slate and gneiss and also the igneous rocks, which do not differ from those usually found in other parts of the globe; the mica and the gneiss however alternate with and pass into each other.

Except in some indistinct vegetable impressions in the coal formation, no organic remains have yet been found in Newfoundland;* but it must be remembered that its rocks have not yet been subjected to the careful examination of modern geologists, nor yet to the keen scrutiny of some of the younger members of this society, whose well directed exertions have enabled them to discover evidences that animal life had existed in formations which were supposed to be far below the existence of any living thing.

The strike throughout the island rarely varies from a true N. N. E., and S. S. W. course.

Hence, all the other prominent features of the country run in the same direction, not only as regards the ranges of hills, but also the principal lakes; all the deep bays and the numerous valleys lie in the same line of bearing.

The strike of the cleavage is not invariably parallel to the strike of the beds; but the cleavage is much more constant as regards the strike and dip in relation to the points of the compass

* Trilobites of the Genus *Paradoxides* have been found in the older slate formation of Mr. Jukes, and several lower silurian fossils have been obtained by Mr. Richardson, of the Geological Survey of Canada, in the limestone formation of the North of the Island, described in the concluding part of this paper.

than it is in relation to the strike and dip of the beds, or than those latter are to the horizon, and points of the compass.

As regards the relative age of the igneous rocks, Mr. Jukes supposes that the granites are generally newer than the mica slate and the gneiss, which repose upon them.

The coal formation seems to be contemporaneous with those of western Europe, Nova Scotia, Cape Breton, and New Brunswick, and with the most modern group of stratified rocks in Newfoundland.

On the west coast of Newfoundland, as might have been prophesied by the most casual geological observer of the formations of Cape Breton and the adjacent shores of the mainland, there exists the continuation of the coal formation of New Brunswick, Nova Scotia and Cape Breton, the great coal basin of the St. Lawrence, probably the largest in the world, extending from the Bay of Chaleur to the profound solitudes, vast morasses, tangled forests and innumerable lakes, ponds, and brooks, which cover and intersect so great a portion of Newfoundland.

The province of Avalon is nearly separated from the rest of Newfoundland by the Bays of Placentia and Trinity, a narrow isthmus only between 3 or 4 miles in width, existing between those two deep and spacious bays, and thus connecting Avalon with the main body of Newfoundland.

In Avalon there are two principal ranges of hills, which form regular watersheds.

The most easterly range is that which rises from the back of Reneuse to Holyrood in Conception Bay. Though not lofty, this range is very rugged, the faces of the hills being abrupt and precipitous. Along this range are some remarkable hummocky hills called the "butter-pots," of which the passing voyager between Cape Race and St. John's has a capital view in fine weather. Each of these "butter-pots" has about the same height above the sea, probably rather more than 1000 feet.

The southern coast of Newfoundland has very lofty cliffs, and the high lands contiguous to the sea exclude all view of the interior from that quarter. Mr. Jukes declares his belief that the country is composed chiefly, if not entirely, of granite.

Three varieties of granite were observed; one white, rather fine grained, with abundance of mica; another of a coarse grain, with less mica and of a reddish colour; and the third, by far the most abundant, a somewhat coarse red granite with large imbedded crystals of flesh-coloured feldspar.

The country, from the Dead Islands to Port aux Basques and Cape Ray, is composed entirely of mica slate and gneiss; and these rocks continue around Cape Ray for some distance to the little Cadroy river where they terminate.

A chain of hills, called the Long Range, composed almost entirely of this gneiss and mica slate, runs into the country from Cape Ray and is believed to intersect and divide the whole Island.

The south side of St. George's Bay, between this Long Range and the Gulf of St. Lawrence, is occupied by the coal formation.

The cliffs on the sea-shore and a band of country a few miles wide, lying parallel to it, exhibit the lower beds of the coal formation, namely the red sandstones and marls, with gypsum.

In the cliffs, near Cadroy Island, (where the writer first landed in Newfoundland) there is much red and green marl, with bands of white flag-stone.

The white flag-stone, and the greenish marl, contain many veins of white fibrous gypsum, and interstratified with these and the red marls are some thirty beds of white and grey gypsum, of a singular character.

The Micmac Indians of this coast report a bed of coal, of two feet in thickness, some distance up the Cadroy river; but Mr. Jukes was unable to procure a guide to it. The bed is said to be of very considerable extent.

Mr. Jukes, however, penetrated the coal formation from Crabb's River, which is about half way up the south side of St. George's Bay. He found that at least six miles of the country, formed of the lower beds of this formation, must be crossed directly from the coast, before arriving at the higher beds, in which the coal is situated.

Having passed over the lower beds, Mr. Jukes at length arrived at a bed of coal, three feet in thickness, resting on soft brown sandstone, with ferruginous stains. Whether this seam of coal was the whole, or only the lower portion of a bed, could not be determined; but the quality was found to be good, as it proved a bright, caking coal.

The distance from the sea shore, where this coal was found, is about 8 miles; but the nearest and only harbour is that of St. George's, distant about 20 miles. From the best observations Mr. Jukes was able to make, he concluded that the tract in which coal might be found, would be an oval, some 20

or 30 miles long, by 10 miles in width, bounded by the sea coast on the north, and the range of primary hills on the south.

Mr. Jukes penetrated the interior more to the north east, by the Grand Pond, and near its eastern extremity, on the banks of a small brook, discovered a seam of coal, *part of it resembling cannel coal*—and in the bed of the brook itself, which is rapid and rocky, large pieces of coal were found, clearly showing that more beds existed higher up the stream.

There is here a large district, throughout the whole extent of which it is probable coal may be found.

The north side of St. George's Bay is occupied by magnesian limestone, lying above the shale of the coal measures, in which shale it is alleged coal has been found at Port-aux-Ports.

The country between Port-aux-Ports and Bay of Islands, and thence northerly to Bonne Bay, and Cow Head—is lofty and unbroken, (the writer now speaks from his own observations) and is occupied chiefly by igneous rocks.

Around Lark Harbour, the rocks are high, pointed and precipitous, consisting of igneous rocks of the most varied character, the scenery is wild, picturesque, and in the elevated portions, sterile to the last degree. Down the deep and narrow ravines, the winds rush with fearful violence, and the suddenness of the gusts are such as to render the operation of beating into Lark Harbour very exciting.

From the neighbourhood of Lark Harbour, nearly to the head of Humber Sound (a magnificent piece of water, by the way, interspersed with numerous islands, having broad and deep channels between them, forming altogether wonderfully striking scenery of unusual character) the rocks consist of dark brown and red schist or shale, grey gritstones, and black, grey, and red slate. Beyond this commences the great calcareous formation, which is supposed to form almost the entire north eastern extremity of Newfoundland.

At the north of the Humber, by far the largest river in Newfoundland, this formation consists of beds of limestone, containing veins and flakes of mica, so entangled with quartz rocks, and intimately associated with the gneiss and mica slate, as to leave no doubt of its being entitled to the denomination of a primary limestone.

The highest beds of this limestone are of a hard dark grey colour, with brown concretions, that on a surface which had

for some time been exposed to the weather, stood out in bold relief.

Below these higher beds, are some thin beds of hard sub-crystalline limestone—some white, and some flesh coloured with white veins.

These thin beds have a thickness of about 100 feet, and from the thickness of the beds they are especially adapted for marble slabs, as they would take a good polish, and be highly ornamental.

Below this formation lies a few feet of thin-bedded black marble, of similar qualities.

Still farther down come large masses of grey compact limestone, having a thickness of 300 or 400 feet, passing into a perfectly white saccharine limestone, without any mark of stratification, and but few joints, or division lines of any kind.

About three miles up the Humber River, it forms lofty white precipices, of pure marble, crowned and surrounded by thick woods, which, closing in upon the rapids, produce most picturesque scenery.

Blocks of this magnificent marble, of any size required, might be procured here, and readily floated down the river into the sound, where vessels of any size may find safe and excellent anchorage.

From Cow Bay northward, along the west coast of Newfoundland, the coast is low, and altogether of primary limestone, which appears to form a belt of two or three leagues in width, bounded by a lofty ridge of mica slate, gneiss, and their associated rocks, forming apparently a continuation of the Long Range, and extending to Lake Quirpon, the extreme northern point of the island of Newfoundland.

This country has not yet been examined by any geologist, and the writer speaks of its general features from observations made while passing to and fro through the straits of Belleisle.

Having thus briefly and imperfectly pointed out the leading geological features of Newfoundland, it only remains to say that in addition to the gypsum which is found abundantly at Cadroy, and the splendid white marble of the Humber, ores of copper, in different varieties, have been found in several districts, and explorations are being carried on by various parties, whose discoveries have not yet been made public.

An extensive deposit of lead was found at La Manche in Pla-

centia Bay, on the southern coast, which was worked for a short time by an American company, who carried away from it many hundred tons of valuable ore.

The people of Newfoundland are sanguine that gold will be found in their island, which is quite possible; the geological character of the island, in some of its characteristics, might warrant the belief, and induce some exertions to explore it more thoroughly.

Any notice of Newfoundland would be imperfect without an allusion to its fisheries, which furnish employment to its people, and provide its staple export. The Arctic current which passes swiftly and continuously along its eastern coast, rendering that side cold, damp, and cheerless—the dense fogs occasioned by this icy current meeting the lighter and warmer waters of the Gulf stream—the long, deep, and narrow arms of the sea, which penetrate far into the land, in every part of the island, and resemble very closely the “fjords” of Norway and Sweden, in all their principal features, affording the best and safest of harbours, —together with the fish and fishing of Newfoundland—will furnish ample materials for other papers hereafter.

[While the above paper was in the hands of the printer, intelligence reached us of the untimely decease of its able and accomplished author. Mr. Perley was a man eminent for his powers of observation, and possessed a vast store of information on the physical features and resources of the maritime provinces, which he was ever ready to render useful to his countrymen. He is well known in British America, and abroad, as the author of valuable reports on the fisheries, on timber trees, on emigration, and other subjects of public importance. The paper which we now publish was read before the Natural History Society of New Brunswick, not long before his departure on what was destined to be his last journey, and was kindly sent by the Council of the Society for publication in the *Naturalist*.—EDITORS.]

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